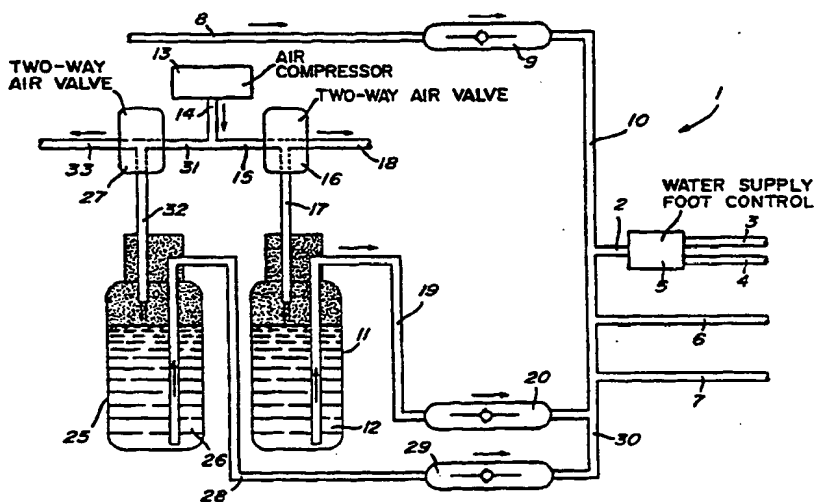




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | | |
|---|--|--|--|
| (51) International Patent Classification n 6: A61C 19/00, 1/00, A61L 2/24 | | A1 | (11) International Publication Number: WO 95/20366 |
| | | | (43) International Publication Date: 3 August 1995 (03.08.95) |
| (21) International Application Number: PCT/CA95/00001 | | (81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ). | |
| (22) International Filing Date: 3 January 1995 (03.01.95) | | | |
| (30) Priority Data: 08/189,434 31 January 1994 (31.01.94) US | | | |
| (71)(72) Applicants and Inventors: PREVOST, André [CA/CA]; 4541 Rosedale, Montreal, Quebec H4B 2H1 (CA). BARBEAU, Jean [CA/CA]; 4582 Euclide Brien, Montreal, Quebec H1X 3H4 (CA). COTE, Ludger [CA/CA]; 451 Saint-Jean, Matane, Quebec G4W 2N4 (CA). CHARLAND, Robert [CA/CA]; 1072 de Randonnai, Boucherville, Quebec J4B 2S9 (CA). SAVAGE, Gary [CA/CA]; 5625 - 17e Avenue, Montreal, Quebec H1X 2R7 (CA). SWIFT, Michel [CA/CA]; 444 Edouard Charles, Outremont, Quebec H2P 2N4 (CA). | | Published With international search report. | |
| (74) Agent: PRINCE, Gaétan; Goudreau Gage Dubuc & Martineau Walker, 3400 The Stock Exchange Tower, P.O. Box 242, Victoria Square, Montreal, Quebec H4Z 1E9 (CA). | | | |

(54) Title: SYSTEM FOR DISINFECTING THE WATER LINES OF A DENTAL UNIT



(57) Abstract

A system for disinfecting the water lines of a dental unit is provided with first and second unidirectional check valves. Water at a first pressure is normally supplied to the water lines of the dental unit through the first check valve. A reservoir of liquid disinfectant can be pressurized at a second pressure higher than the first pressure by the air compressor already equipping the dental unit to supply disinfectant to the water lines of the dental unit through the second check valve. Liquid disinfectant is prevented from reaching the water supply line by the first check valve. In the same manner, when the reservoir is not pressurized, the second check valve prevents water from the water supply line from reaching the disinfectant. The reservoir is formed with an upper neck and a bottom, and the disinfectant system is provided with a housing on which an upper stopper fitting into the neck and a lower reservoir bottom support are mounted, whereby for mounting the reservoir on the housing, one successively tilts the reservoir, places the neck on the stopper and slides the reservoir bottom on the support, which sliding movement is facilitated by a rounded edge of the reservoir bottom.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | | | |
|----|--------------------------|----|--|----|--------------------------|
| AT | Austria | GB | United Kingdom | MR | Mauritania |
| AU | Australia | GE | Georgia | MW | Malawi |
| BB | Barbados | GN | Guinea | NE | Niger |
| BE | Belgium | GR | Greece | NL | Netherlands |
| BF | Burkina Faso | HU | Hungary | NO | Norway |
| BG | Bulgaria | IE | Ireland | NZ | New Zealand |
| BJ | Benin | IT | Italy | PL | Poland |
| BR | Brazil | JP | Japan | PT | Portugal |
| BY | Belarus | KE | Kenya | RO | Romania |
| CA | Canada | KG | Kyrgyzstan | RU | Russian Federation |
| CF | Central African Republic | KP | Democratic People's Republic of Korea | SD | Sudan |
| CG | Congo | KR | Republic of Korea | SE | Sweden |
| CH | Switzerland | KZ | Kazakhstan | SI | Slovenia |
| CI | Côte d'Ivoire | LI | Liechtenstein | SK | Slovakia |
| CM | Cameroon | LK | Sri Lanka | SN | Senegal |
| CN | China | LU | Luxembourg | TD | Chad |
| CS | Czechoslovakia | LV | Latvia | TG | Togo |
| CZ | Czech Republic | MC | Monaco | TJ | Tajikistan |
| DE | Germany | MD | Republic of Moldova | TT | Trinidad and Tobago |
| DK | Denmark | MG | Madagascar | UA | Ukraine |
| ES | Spain | ML | Mali | US | United States of America |
| FI | Finland | MN | Mongolia | UZ | Uzbekistan |
| FR | France | | | VN | Viet Nam |
| GA | Gabon | | | | |

SYSTEM FOR DISINFECTING THE
WATER LINES OF A DENTAL UNIT

5

BACKGROUND OF THE INVENTION

10 1. Field of the invention:

The present invention relates to a system to be mounted to a new or already installed dental unit for disinfecting the water lines thereof.

15

. 2. Brief description of the prior art:

As well known to those of ordinary skill in the art, a bacterial film, called "biofilm" develops in the network of small diameter water lines of a dental unit, which network supplying the handpieces and water/air syringe with water. This biofilm attach to the inner walls of the water lines. After some weeks, this film is visible to the naked eye.

25

When water flows in the water lines, a great quantity of bacteria detach from the biofilm. These bacteria, in suspension in the water, are projected directly in the mouth of the patient and are present in the aerosols produced by the handpieces. Studies have indicated that water from the handpieces and air/water syringe of a dental unit does not meet

30

with the microbiological standards of public health
regarding drinking water. Such concentration of
bacteria, even of non-pathogenic bacteria, constitutes
a potential problem of infection for immuno-deficient
5 patients.

OBJECTS OF THE INVENTION

10

An object of the present invention is
therefore to provide a system capable of efficiently
disinfecting the water lines of a dental unit, in view
of removing the biofilm formed therein.

15

SUMMARY OF THE INVENTION

20

More specifically, in accordance with the
present invention, there is provided a system for
disinfecting water lines of a dental unit, comprising:

first valve means;

means for supplying water at a first
25 pressure to the water lines of the dental unit through
the first valve means; and

means actuated for supplying liquid
disinfectant to the water lines of the dental unit at
a second pressure higher than the first pressure.

30

According to the invention, the first
valve means comprises means responsive to the
difference between the first and second pressures to

prevent disinfectant from reaching the water supplying means.

In accordance with preferred embodiments
5 of the present invention, the first valve means comprises a unidirectional check valve. Also the disinfectant supplying means may comprise a reservoir for storing the liquid disinfectant, this reservoir being pressurized at the second pressure by an air
10 compressor already equipping the dental unit. Moreover, the disinfectant from the reservoir is preferably supplied to the water lines of the dental unit through a second unidirectional check valve whereby, when the reservoir is not pressurized, that
15 second check valve prevents water from the water supplying means to reach the reservoir of disinfectant. The reservoir advantageously comprises an upper neck and a bottom, and the disinfecting system a housing on which an upper stopper fitting
20 into the neck and a lower reservoir bottom support means are mounted, whereby for mounting the reservoir on the housing, one successively tilts the reservoir, places the neck on the stopper and slides the reservoir bottom on the support means, which sliding
25 movement is facilitated by a rounded edge of the reservoir bottom.

Finally, the system for disinfecting water
lines of a dental unit may comprises a second
30 reservoir in which clean water is stored, and means for pressurizing this water reservoir at the second pressure for supplying clean water to the lines of the dental unit through a third unidirectional check valve

when supply of water from the water supplying means is interrupted or when water from the water supplying means is contaminated.

5 The objects, advantages and other features of the present invention will become more apparent upon reading of the following non restrictive description of a preferred embodiment thereof, given by way of example only with reference to the
10 accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

15

In the appended drawings:

Figure 1 is a schematic diagram showing the structure of the system according to the present
20 invention, for disinfecting the water lines of a dental unit;

Figure 2 is a funnel of the disinfecting system according to the present invention;

25

Figure 3 is an elevational view of a vertical housing in which the disinfecting system of the present invention is enclosed;

30

Figure 4 is a horizontal cross sectional view of the housing of Figure 3 enclosing a reservoir of liquid disinfectant; and

Figure 5 is an elevational, partly cross sectional view of the vertical housing of Figure 3, showing how the reservoir of disinfectant is installed and removed from the housing.

5

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

10 The system in accordance with the present invention, for disinfecting the water lines of a dental unit is generally identified by the reference 1 in Figure 1 of the appended drawings.

15 As illustrated in Figure 1, the water lines of a dental unit (not shown) generally comprise:

20 - a water line 2 connected to a foot control 5 for supplying water to dental handpieces through water lines 3 and 4;

 - a water line 6 for supplying an air/water dental syringe (not shown): and

25 - a water line 7 for supplying a unit (not shown) for automatically filling a water glass.

30 As shown in Figure 1, the water lines 2, 6 and 7 are themselves supplied with fresh water through a water supply line 8, a unidirectional check valve 9, and a water line 10. The standard pressure in the water supply line 8 is 45 psi. More

specifically, fresh water is supplied (a) to the foot control 5 through line 8, valve 9, and lines 10 and 2, (b) to the water glass filling unit through line 8, valve 9, and lines 10 and 7, and (c) to the air/water dental syringe through line 8, valve 9, and lines 10 and 6.

The system 1 in accordance with the present invention, for disinfecting the water lines of a dental unit further comprises a reservoir 11 for containing liquid disinfectant 12, and a two-way air valve 16 which can be mechanical or electromechanical.

A dental unit conventionally comprises a compressor 13 for supplying the dental handpieces and syringe with pressurized air. This already available compressor 13 will also be used to supply pressurized air at a pressure of 55 psi to the reservoir 11 to supply liquid disinfectant to lines 2, 6 and 7 through a line 19 and a unidirectional check valve 20.

More specifically, in a first position of the two-way air valve 16, pressurized air from the compressor 13 is supplied to the reservoir 11 through air lines 14 and 15, valve 16 and air line 17. In a second position of valve 16, pressurized air in reservoir 11 is evacuated through line 17, valve 16 and air line 18.

Disinfection of the water lines such as 2-4, 6 and 7 of the dental unit is advantageously carried out at the end of the day's work. The user first turns the control valve 16 from its second

position in which it is normally positioned, to its first position to supply pressurized air at 55 psi from the compressor 13 to the reservoir 11. The user then activates successively or simultaneously the foot control 5, the dental syringe (not shown) and the water glass filling unit (not shown) whereby disinfectant 12 will flow from the reservoir 11 through line 19, check valve 20, and lines 2, 3, 4, 6 and 7 to reach the dental handpieces and syringe, and the water glass filling unit. As pressure of the disinfectant (55 psi) is higher than pressure of water (45 psi) in the water supply line 8, check valve 9 prevents disinfectant from reaching supply line 8. Preferably, the liquid disinfectant 12 is colored to allow the user to see when disinfectant flows from the dental handpieces and syringe and from the water glass filling unit. The water lines of the dental unit are then full of disinfectant whereby the foot control 5, the dental syringe and the water glass filling unit can be turned off. The two-way air valve 16 is turned back to its second position to stop supply of pressurized air to the reservoir 11. Pressurized air from the reservoir 11 is then evacuated through lines 17 and 18, and valve 16. Finally, the water, air and electric supplies of the dental unit are switched off as normally done at the end of the day's work.

The day after, the water, air and electric supplies of the dental unit are switched on. The foot control 5, dental syringe and water glass filling unit are then turned on to evacuate disinfectant 12 from the water lines of the dental unit. As the reservoir 11 is no longer supplied with pressurized air from

compressor 13, water is allowed to flow from supply line 8 through the check valve 9 and lines 2, 3, 4, 6 and 7, but is prevented from reaching the reservoir 11 by the action of check valve 20. Evacuation of the
5 disinfectant is completed when the liquid from the handpieces, syringe and water glass filling unit is no longer colored. The dental unit can then be operated as usual.

10 To facilitate the use of the disinfecting system 1 of the present invention, a funnel 21 illustrated in Figure 2 is used. Funnel 21 comprises a narrow end formed with a cylindrical tube 22 that
15 can be readily mounted on the suction apparatus (not shown) of the dental unit. Funnel 21 also comprises a wider end 23 including a plurality of openings such as 24 to receive the outlet tubes of the handpieces, dental syringe, water glass filling unit, etc. or the
20 free end of the water lines thereof. Funnel 21 is preferably made of translucent plastic material to enable the user to see the color of the liquid flowing therein.

The system 1 in accordance with the
25 present invention, for disinfecting the water lines of a dental unit further comprises a reservoir 25 for containing clean water 26, and a two-way air valve 27 which can be mechanical or electromechanical. The
30 already available compressor 13 will supply pressurized air at a pressure of 55 psi to the reservoir 25 to supply clean water to lines 2, 6 and 7 through a water line 28, a unidirectional check valve 29, and a water line 30.

More specifically, in a first position of the two-way air valve 27, pressurized air from the compressor 13 is supplied to the reservoir 25 through air lines 14 and 31, valve 27 and air line 32. In a
5 second position of valve 16, pressurized air in reservoir 25 is evacuated through line 32, valve 27 and air line 33.

When water from the supply line 8 is
10 contaminated or supply of water from line 8 is interrupted, one has only to turn valve 27 from its second position in which it is normally positioned, to its first position to supply pressurized air at 55 psi from the compressor 13 to the reservoir 11. Clean
15 water from reservoir 25 is then supplied to the lines 2, 6 and 7 through water line 28, check valve 29 and water line 30 whereby the dentist or dentist assistant can continue to use the dental handpieces and syringe, and the water glass filling unit. As pressure in the
20 reservoir 25 (55 psi) is higher than pressure of water (45 psi) in the water supply line 8, check valve 9 prevents clean water 26 from reservoir 25 from reaching supply line 8.

25 When the supply of water from line 8 is reestablished, the two-way air valve 27 is turned back to its second position to stop supply of pressurized air to the reservoir 25. Pressurized air from the reservoir 25 is then evacuated through lines 32 and
30 33, and valve 27.

Alternatively, reservoir 25 may also contain liquid disinfectant as reservoir 11.

As illustrated in Figure 3, the system 1 in accordance with the present invention is advantageously enclosed in a housing 34 presenting the shape of a hollow column generally oval in cross section (Figure 4). Column 34 can be easily mounted in the proximity of a dentist's chair (not shown) in the region of the water and air connections. Obstruction caused by the disinfecting system 1 of the invention is thereby minimized.

10

As shown in Figures 3 and 4, housing 34 is formed of three extrusions 35, 36 and 37. Outer extrusion 37 is hinged on central extrusion 36 whereby housing 34 can be opened to install the reservoirs 11 and 25 therein.

15

A generally conical stopper 38, made of flexible plastic material, is fixedly mounted in the housing 34. More specifically, stopper 38 is mounted on a support 39, made of sheet metal secured to the inside of extrusion 36. Stopper 38 is traversed by line 17,32 for supplying pressurized air to the reservoir 11,25, and by line 19,28 for supplying liquid from that reservoir 11,25. Line 19,28 is flexible and extends downwardly from stopper 38 to reach the bottom of reservoir 11,25.

20

25

The reservoir 11,25 is advantageously made of plastic material. It presents the general shape of a parallelepiped and is formed with an upper cylindrical neck 41 dimensioned to fit on stopper 38. The bottom of reservoir 11,25 has a rounded edge 42 and is formed with cavities such as 43.

30

A support 40, made of sheet metal and secured to the inside of central extrusion 36 receives the bottom of reservoir 11,25.

5 Therefore, to install a reservoir 11,25 in the housing 34, this reservoir 11,25 is tilted and neck 41 placed around stopper 38. The bottom of reservoir 11,25 is then pushed inside housing 34 to slide onto support 40. The bottom of reservoir 11,25
10 is then applied to the support 40 and neck 41 tightly sealed by stopper 38. Extrusion 37 is finally pivoted to close housing 34 whereby reservoir 11,25 is held in place in that housing. As can be appreciated, rounded edge 42 facilitates insertion of a full reservoir
15 11,25 in the housing 34, while cavities 43 makes manual removal of an empty reservoir 11,25 easier.

As shown in Figure 5, the two reservoirs 11,25 are superposed and are mounted in housing 34 in
20 the same way.

The reservoirs 11 and 25 and/or the housing 34 are preferably opaque to prevent light to pass through them and possibly deactivate the
25 disinfectant. Advantageously, the reservoirs 11 and 25 will be opaque with a thin elongate and vertical translucent window enabling visual inspection of the level of disinfectant in the reservoirs.

30 When the dental unit of the dentist and the dental unit of the dentist's assistant have a common water supply, only one disinfecting system 1 in accordance with the present invention is required.

Also, the disinfecting system 1 of the present invention must be installed downstream the vinyl water lines of the dental unit in which the biofilm grows.

5

Although the present invention has been described hereinabove by way of a preferred embodiment thereof, this embodiment can be modified at will, within the scope of the appended claims, without departing from the spirit and nature of the subject invention.

10

WHAT IS CLAIMED IS:

1. A system for disinfecting water lines
5 of a dental unit, comprising:
first valve means;
means for supplying water at a first
pressure to said water lines through the first valve
means; and
10 means actuated for supplying liquid
disinfectant to said water lines of the dental unit at
a second pressure higher than the first pressure;
wherein said first valve means comprises
means responsive to the difference between said first
15 and second pressures to prevent disinfectant from
reaching the water supplying means.
2. A system for disinfecting water lines
of a dental unit as recited in claim 1, wherein said
20 first valve means comprises a unidirectional check
valve.
3. A system for disinfecting water lines
of a dental unit as recited in claim 2, in which said
25 water supplying means comprises a water supply line
connected to said water lines of the dental unit
through the unidirectional check valve.
4. A system for disinfecting water lines
30 of a dental unit as recited in claim 1, wherein the
disinfectant supplying means comprises a reservoir for
storing said liquid disinfectant, and means for
pressurizing said reservoir at said second pressure.

5. A system for disinfecting water lines of a dental unit as recited in claim 4, in which said pressurizing means comprises an air compressor already equipping said dental unit.

5

6. A system for disinfecting water lines of a dental unit as recited in claim 4, further comprising second valve means through which disinfectant from said reservoir is supplied to said lines of the dental unit, wherein, when the reservoir is not pressurized, said second valve means comprises means responsive to said first pressure for preventing water from said water supplying means to reach said reservoir.

10

15

7. A system for disinfecting water lines of a dental unit as recited in claim 6, in which said second valve means comprises a unidirectional check valve.

20

8. A system for disinfecting water lines of a dental unit as recited in claim 4, wherein said reservoir comprises an upper neck and a bottom, and wherein said disinfecting system further comprises a housing on which an upper stopper fitting into said neck and a lower reservoir bottom support means are mounted, whereby for mounting said reservoir on said housing, one successively tilts said reservoir, places said neck on said stopper and slides said reservoir bottom on said support means.

25

30

9. A system for disinfecting water lines of a dental unit as recited in claim 8, in which the

bottom of the reservoir is formed with a rounded edge to facilitate sliding of said bottom on the support means.

5 10. A system for disinfecting water lines of a dental unit as recited in claim 1, further comprising a reservoir in which clean water is stored, and means for pressurizing said reservoir at a third pressure higher than said first pressure to supply
10 water from said reservoir to said water lines of the dental unit when supply of water from the water supplying means is interrupted or when water from the water supplying means is contaminated.

15 11. A system for disinfecting water lines of a dental unit as recited in claim 10, in which said pressurizing means comprises an air compressor already equipping said dental unit.

20 12. A system for disinfecting water lines of a dental unit as recited in claim 10, further comprising second valve means through which water from said reservoir is supplied to said water lines of the dental unit, wherein, when the reservoir is not
25 pressurized, said second valve means comprises means responsive to said first pressure for preventing water from said water supplying means to reach said reservoir.

30 13. A system for disinfecting water lines of a dental unit as recited in claim 12, in which said second valve means comprises a unidirectional check valve.

14. A system for disinfecting water lines of a dental unit as recited in claim 10, wherein said reservoir comprises an upper neck and a bottom, and wherein said disinfecting system further comprises a housing on which an upper stopper fitting into said neck and a lower reservoir support means are mounted, whereby, for mounting said reservoir on said housing, one successively tilts said reservoir, places the neck onto said stopper and slides the reservoir bottom on said support means.

15. A system for disinfecting water lines of a dental unit as recited in claim 14, in which said bottom of the reservoir comprises a rounded edge to facilitate sliding of said bottom on the support means.

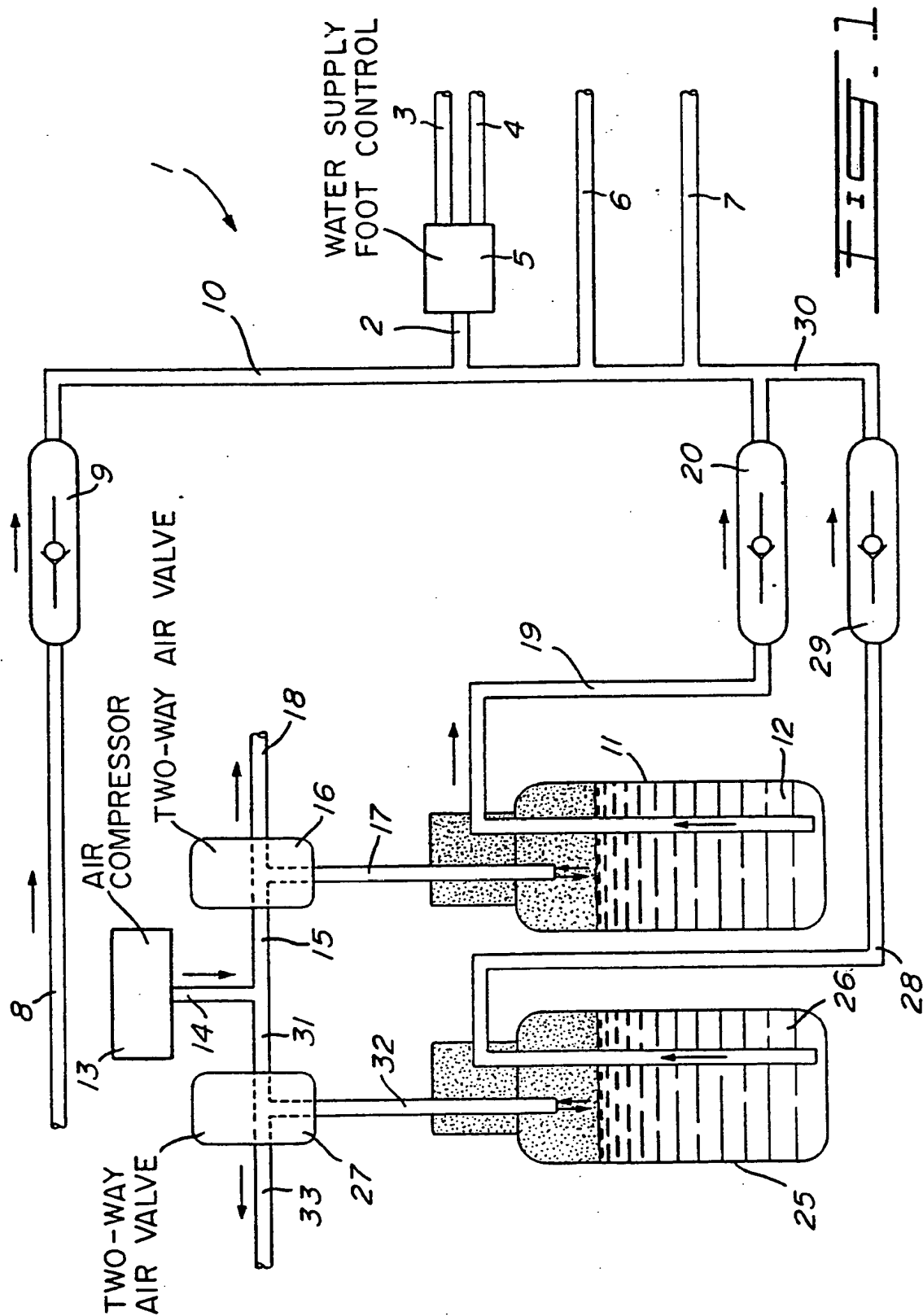
16. A system for disinfecting water lines of a dental unit as recited in claim 1, wherein the disinfectant supplying means comprises a first reservoir for storing liquid disinfectant, and wherein said disinfecting system further comprises:

a second reservoir in which liquid disinfectant or clean water is stored;

means for pressurizing said second reservoir at a third pressure higher than said first pressure to supply disinfectant or water from said second reservoir to said water lines of the dental unit;

a housing formed of a hollow column; and means for superposing said first and second reservoirs in said hollow column.

1/3



2/3

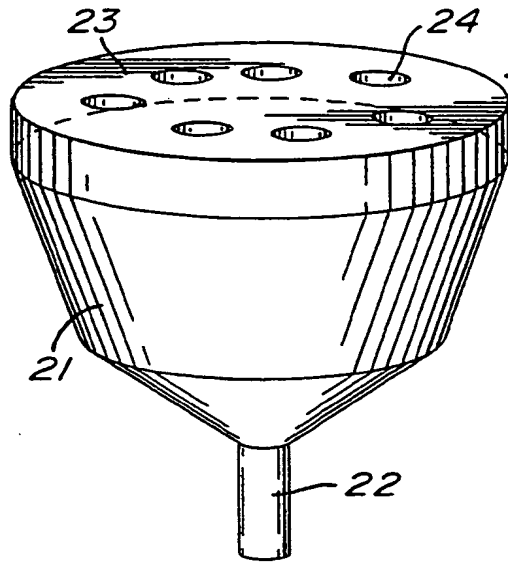


FIG. 2

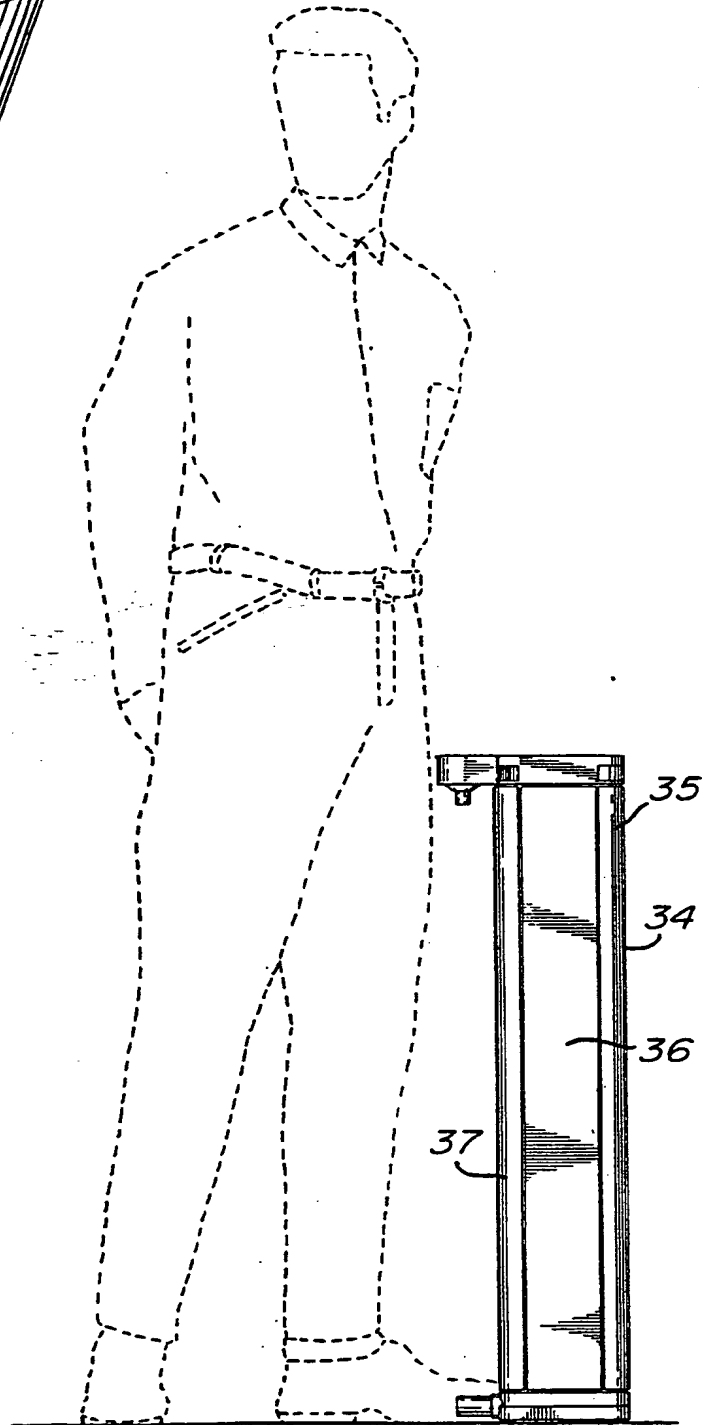
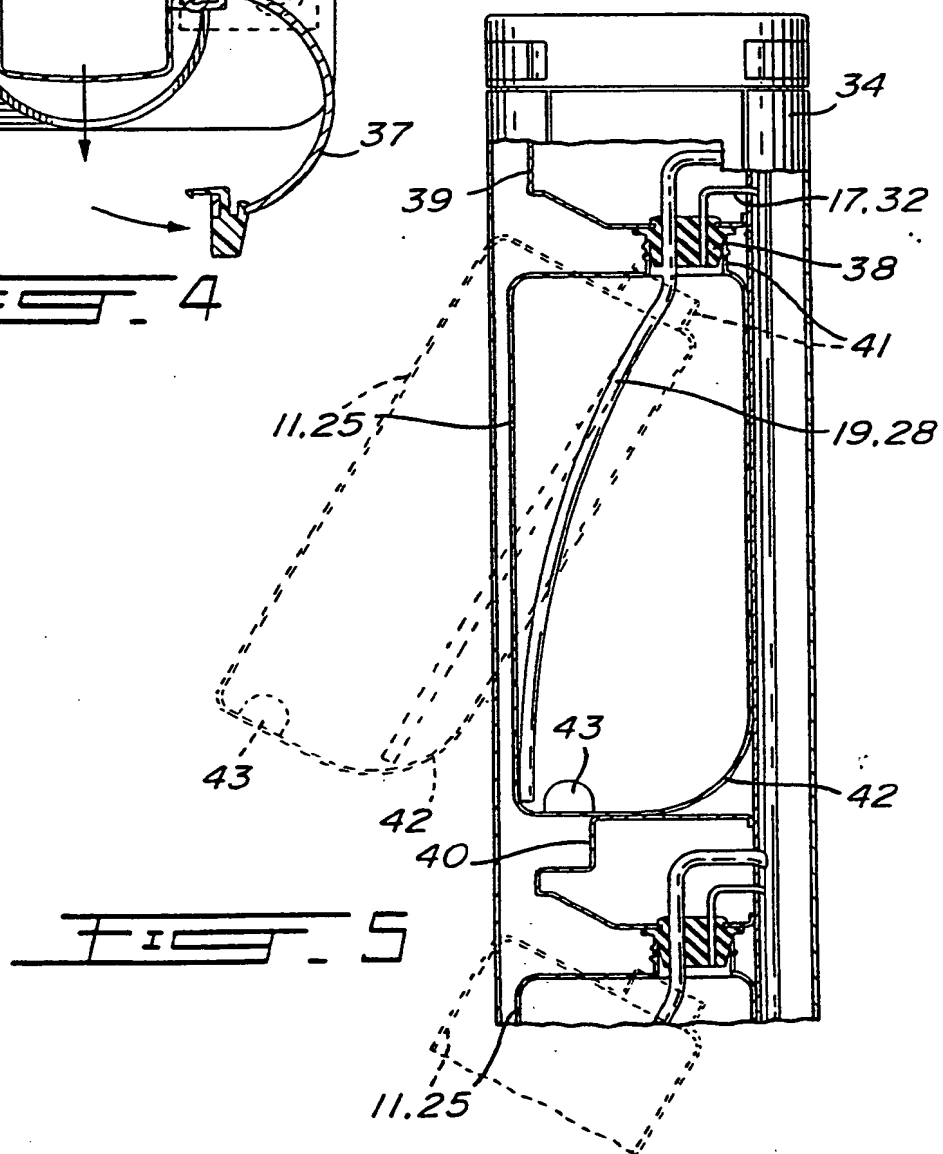
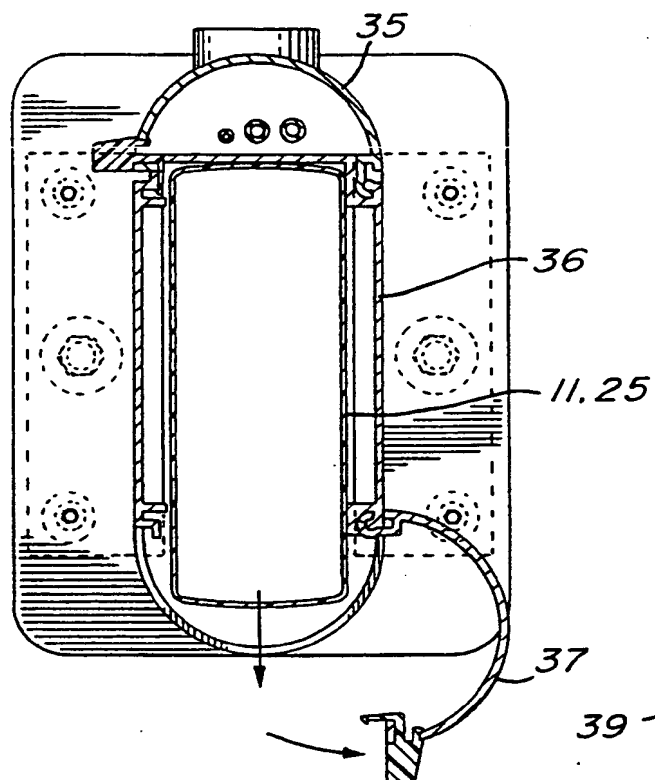


FIG. 3

3/3



INTERNATIONAL SEARCH REPORT

Inter. Appl. Application No
PCT/CA 95/00001

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61C19/00 A61C1/00 A61L2/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61C A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A | EP,A,0 111 249 (SIEMENS) 20 June 1984 see the whole document --- | 1 |
| A | EP,A,0 233 847 (CASTELLINI) 26 August 1987 see the whole document --- | 1 |
| A | EP,A,0 317 521 (CASTELLINI) 24 May 1989 see the whole document --- | 1 |
| A,P | US,A,5 318 443 (OVERMYER) 7 June 1994 see the whole document ----- | 1 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

5 April 1995

Date of mailing of the international search report

21.04.95

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+ 31-70) 340-3016

Authorized officer

Raybould, B

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 95/00001

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|--|--|
| EP-A-0111249 | 20-06-84 | DE-A- 3246266 JP-C- 1592664 JP-B- 2014115 JP-A- 59115780 US-A- 4545956 | 14-06-84 14-12-90 06-04-90 04-07-84 08-10-85 |
| EP-A-0233847 | 26-08-87 | DE-A- 3635568 JP-A- 62197050 | 27-08-87 31-08-87 |
| EP-A-0317521 | 24-05-89 | DE-A- 3864984 JP-A- 1164358 JP-C- 1769064 JP-B- 4050823 | 24-10-91 28-06-89 30-06-93 17-08-92 |
| US-A-5318443 | 07-06-94 | NONE | |

